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U.S. Nuclear Regulatory Commission
ATTN: Mrs. Deborah A. DeMarco
Two White Flint North
11545 Rockville Pike
Mail Stop T8A23
Washington, DC 20555

Subject: Programmatic Review of an Abstract

Dear Mrs. DeMarco:

The enclosed abstract is being submitted for programmatic review. This abstract will be submitted for presentation at the Geological Society of America 2002 Annual Meeting and Exposition to be held October 27–30, 2002, in Denver, Colorado. The title of the abstract is:

> "The Cold-Trap Process and Its Effect on Moisture Distribution and Chemistry of Water in Drifts" by R. Fedors, J. Prikryl, S. Mayer, L. Browning, and F. Dodge

Please advise me of the results of your programmatic review. Your cooperation in this matter is appreciated.

Sincerely,

Budhi Sagar
Technical Director

/ph
Enclosure
cc: J. Linehan (w/o encl.), B. Meehan, E. Whitt, W. Reamer, J. Pohle, L. Campbell, J. Schlueter, K. Stablein, D. Brooks, T. McCartin, P. Justus, J. Greeves, B. Leslie, T. Essig, J. Bradbury, M. Nataraja, W. Patrick, A. Chowdhury, T. Nagy (SwRI Contracts), Letter only: CNWRA Directors, CNWRA Element Mgrs., P. Maldonado, R. Green, R. Fedors, C. Mannepally, C. Dinwiddie

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GSA Session
" Characterizing Geochemical Processes: When is There Sufficient Information?"

The Cold-Trap Process and its Effect on Moisture Distribution and Chemistry of Water in Drifts

Randall Fedors, James Prikryl, Stefan Mayer, Lauren Browning, and Franklin Dodge

The quantity and chemistry of water contacting waste packages stored underground in drifts are important factors for determining the performance of the proposed high-level radioactive waste repository at Yucca Mountain, Nevada. Elevated temperatures and high concentrations of some halogens are known to enhance or initiate drip shield (DS) and waste package (WP) corrosion. The cold trap process describes a mechanism for in-drift water movement, possibly providing localized liquid water that may contact the DS and WP, and after failure, providing a liquid water pathway for radionuclide transport away from the drifts. The cold-trap process involves evaporation from warm areas, movement of vapor driven by thermal gradients, and condensation on cool surfaces.

There are many uncertainties involved with simulating the quantity and chemistry of water in drifts. Predicting moisture movement associated with the cold trap process itself, is complex. Natural convection, when acting in concert with thermal radiation, conduction, and latent heat transfer caused by evaporation and condensation, is poorly understood. Furthermore, scaling of thermal processes is highly nonlinear. The cold trap process provides condensate that is essentially pure water with a pH dependent on the atmospheric CO_2(g) content. However, mixing of waters from different sources (e.g., condensation and seepage), each of which may have contacted and reacted with different materials (substrate, residues, or dust), makes it difficult to predict chemical compositions of the water in drifts. Furthermore, because of this complexity, sparse laboratory or field data exist to support simulations of thermal-hydrologic-chemical coupled processes of in-drift environmental conditions.

The cold trap process was evaluated in a scaled laboratory model of a heated drift using thermocouples, relative humidity probes, and anemometers to measure environmental conditions. Preliminary results from the laboratory test support results from an analytical solution of air flow patterns and condensation rate. A computational fluid dynamics code and a two-phase porous media and reactive transport code are being calibrated to expand the predictive capabilities beyond the results measured in the laboratory experiment. This presentation will summarize existing published work supporting analysis of the cold trap process, present preliminary results from scaled laboratory experiments and corresponding modeling, and highlight the large data gap that exists for building confidence in the thermal-hydrologic-chemical modeling approach.